Tabiscope: Mobile Device Camera Connector

Paper Seminar by Deepak Lingam | Group 7

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1. Project Statement

The tabiscope project is focused on creating a low cost alternative to the traditional towers used in endoscopy. We aim to design an adapter to connect an external camera such as a point and shoot camera or a web camera to the eye piece of an endoscope. Along with this, a second arm of the project is working on developing software for use on an Android tablet. It is the goal of this project to use the tablet as a replacement for the endoscope towers currently in use. We hope to stream the images from the external camera to the tablet in real-time to allow for ease of viewing. Lastly, this project's third arm is to create an easy method of image sharing between doctors to reduce the number of endoscopic procedures done on patients.

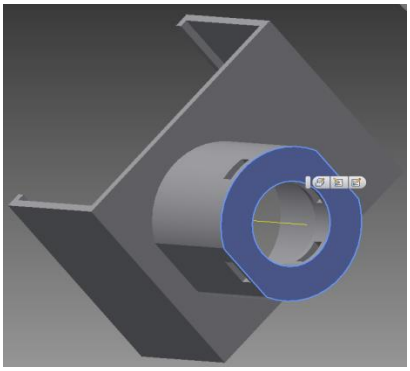


Figure 1 Deepak Lingam using Autodesk Inventor

2. Paper Selection

2.1
Levitan, Richard M., Ted S. Goldman, Donald A. Bryan, Frances Shofer, and Andrew Herlich. "Training with Video Imaging Improves the Initial Intubation Success Rates of Paramedic Trainees in an Operating Room Setting." *Annals of Emergency Medicine* 37.1 (2001): 46-50. Print.

2.2
Ayoub, C. M., G. E. Kanazi, A. Al Alami, C. Ramesh, and M. F. El-Khatib. "Tracheal Intubation Following Training with the GlideScope Compared to Direct Laryngoscopy." *Journal of the Association of Anaesthesists of Great Britain and Ireland* 65.7 (2010): 674-78. *Wiley Online*. Web. 1 Apr. 2014.

2.3
These papers were selected because they highlight the benefits of using video during the training of EMTs and medical students on how to successfully intubate patients.. Based on the results of Levitan et. al. and Ayoub et. al, our project can also help with training in third world areas by reducing the equipment costs necessary for acquiring camera visuals during a procedure. Additionally, video training has the potential to be beneficial for endoscopic methods as well. Both intubation and other forms of endoscopy have similar needs in recognizing anatomical landmarks. Another aspect that the Levitan paper touches upon is that the training videos can be watched anywhere, and the relative mobility of our solution can also lead to an increase in video training opportunities.

Figure 2 Kyle Wong and Daniel Ahn using Tabiscope

3. Summary of problem and results

3.1 The problem

3.1.1
Traditional training methods for EMTs instruct people using line drawings and mannequins. Trainees practice intubation and using scopes on these dummies repeatedly until they are deemed fit to work on a

patient. However, these mannequins and line drawings lack the distinctiveness of real human anatomy. There are few natural landmarks in the mannequins and drawings, which leads to difficulty during actual procedures.

3.1.2
The traditional method for training medical students in intubation and laryngoscopy uses the rigid scope known as a Macintosh laryngoscope. Students attend lectures on airway inspection, followed by observing senior anesthesiologist perform procedures a mannequin and then on patients who have given consent. Once this was done, the students attempted intubations on patients.

3.2 The objective

3.2.1
The purpose of this paper was to determine the effects of using laryngoscopy videos during training. Levitan et. al. wanted to see whether giving trainees videos from a camera attached to the end of the laryngoscope would increase intubation success rates.

3.2.2
In this paper, the students are split into two groups in order to determine whether using the GlideScope is more effective for training purposes than the rigid Macintosh scope.

3.3 The key results

3.3.1
Evidence from the study indicates that using laryngoscope videos does increase the success rate of intubations. However, the authors do indicate that there could have been some confounding factors at play that biased the results of the study.

3.3.2
Results of this study show that the GlideScope increased the success rates of medical students in intubation. The other result the authors indicated is that the medical students who trained with the video scopes managed to complete the procedure in a shorter time span.

4. Significance and Background

Intubation is a skill that requires training in order to become proficient at it. Current training methods involve practicing on line drawing models or mannequins. EMT trainees and medical students practice repeatedly on the mannequins in order to get the technique down. However, the mannequins do not have the same set of landmarks as an actual body. In addition, each human body is slightly different, so practicing on a dummy does not give trainees the skills necessary to spot landmarks despite anatomical differences. Using a camera allows students to get the same viewpoint as the attending physician who is actually holding the scope. This allows them to understand what the doctor is saying as he performs the procedure. Both the EMTs and the medical students will also get the opportunity to notice real landmarks as the instructor points them out.

5. Materials and Methods

5.1
The authors used data from the Star Technical Institute located in Philadelphia. All of the students underwent the same traditional training. This training included forty two hours of classroom instruction following the national standards as well as additional time spent practicing with mannequins. Along with this training, trainees also got the opportunity to observe operating room intubations. The video group

also received a twenty six minute video containing fifteen real laryngoscopies. The students watched this video three times before doing the practical part of the training. All of the students were then monitored in the operating room, where a supervising anesthesiologist kept track of the number of attempts the student made as well as the number of the intubation attempts that were successful. The results from the two groups were later compares in order to determine the effects of the laryngoscope videos.

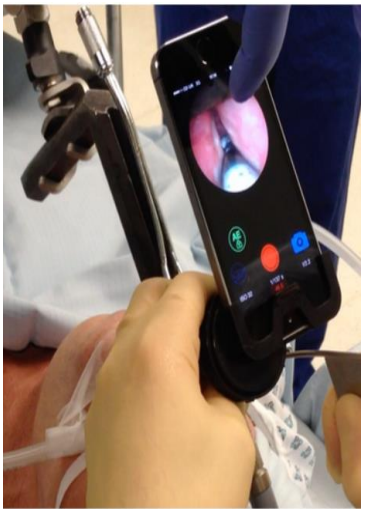


Figure 3 Courtesy of endoscope-i

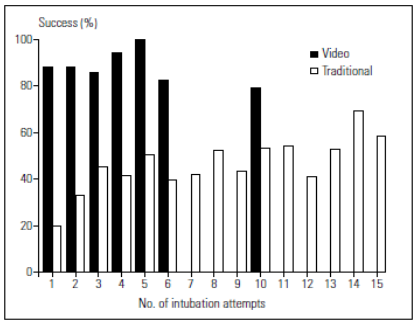
5.2

The authors conducted this study at the American University of Beirut Medical Center. They took forty two students and split them into two equal groups. One of the groups trained using the Macintosh rigid scopes, while the second group used the GlideScope video assisted laryngoscopes. Both groups consisted of students who had no prior experience in tracheal intubation. They all attended lectures on how to evaluate and diagnose airways. Next, they split into the two groups. The first group observed a senior anesthesiologist use the rigid scope on a mannequin while the second group observed the senior use the video scope on the mannequin. The students then observed the anesthesiologists perform procedures on three patients. Once the training was complete each student got the opportunity to perform three intubations and was scored on his performances. Additionally, the student was timed for each attempt.

6. Results

6.1

First off, one must know the number of students in each trial group. In the purely traditional training group, there were one hundred and thirteen students spanning four years. Combined, these students performed seven hundred and eighty three insertions. The video group consisted of thirty six students who performed a combined total of one hundred and two laryngoscope insertions. As stated in the methods section, while each student performed the insertion, there was a supervising anesthesiologist in the room who determined whether the procedure was performed successfully or not. The data from the traditional group shows that they had a mean success rate of 46.7% using a 95% confidence interval. The experimental group had a mean success rate of 88.1% also using a 95% confidence interval.



Group	No. of Attempts	No. of Trainees	Successful Intubation (%)
Traditional			
	1	5	20
	2	3	33
	3	8	46
	4	6	42
	5	16	51
	6	21	40
	7	2	43
	8	18	53
	9	2	44
	10	21	54
	11	1	55
	12	7	42
	13	1	54
	14	1	71
	15	1	60
Video			
	1	8	88
	2	8	88
	3	12	86
	4	4	94
	5	2	100
	6	1	83
	10	1	80

*The number of trainees within each subgroup is listed in the middle column.

Figure 4 Graph and table from Levitan et. al. Training With Video Imaging Improves the Initial Intubation Success Rates of Paramedic Trainees in an Operating Room Setting

The researchers also compared the results by breaking down the two groups into subgroups based on the number of intubation attempts made. They then compared the success rates amongst students with the same number of attempts. The results are noted in the graph on the right as taken from the research paper. Even in these subgroups, those students who viewed the videos had a significantly higher success rate. The reason for the lack of video students in some of the subgroups is probably due to the shorter time frame in which the video training has

been used. The table summarizes the results from the graph.

6.2
Each group consisted of twenty one students each and each student was scored on the three attempts that they performed. This led to sixty three total trials that provided data for the paper. The authors note that there is no statistical differences within each group when comparing the first, second and third trials to each other. However, the result that stands out is that there is a statistical difference in the success rates between the GlideScope group and the Macintosh group. The success rate for the GlideScope group was 47.6% the first attempt, 69.9% the second attempt and 80.9% the third attempt. Compared to this, the Macintosh group had a success rate of 14.3% the first attempt, 14.3% the second attempt and 33.3% the third attempt. Ayoub et. al. also note that the GlideScope group had significantly shorter procedure times than the Macintosh group, 50-59 seconds versus 67-71 seconds respectively.

	GlideScope	Macintosh	p value
Success rate of 1st intubation	47.6 (28.3–67.6)	14.3 (5–34.7)	0.043
Success rate of 2nd intubation	69.9 (40.9–79.3)	14.3 (5–34.7)	0.004
Success rate of 3rd intubation	80.9 (60–92.3)	33.3 (17.2–54.6)	0.004

	GlideScope	Macintosh	p value
Time of 1st intubation; s	59.3 (4.4)	70.7 (7.5)	0.006
Time of 2nd intubation; s	56.6 (7.1)*	73.7 (7.3)	0.003
Time of 3rd intubation; s	50.1 (4.0)†‡	67.6 (2.0)	< 0.001

*p = 0.012 vs time of 1st intubation in GlideScope group.
†p < 0.0001 vs time of 1st intubation in GlideScope group.
‡p = 0.013 vs time of 2nd intubation in GlideScope group.

Figure 5 These two tables were obtained from Ayoub et. al. Tracheal Intubation following training with the GlideScope compared to direct laryngoscopy

7. Assessment

7.1
Based on the results from the above section, it is clear that the training videos have a positive effect on intubation success rates. It should be noted that this study was done using data from four years. So, further research should be conducted longitudinally in order to gauge the long term potency of video training. However, as seen above, even the subgroups show the benefits of using laryngoscope videos during training. One of the positive things to note is that the study found no difference in the results when looking at participants based on age, sex and level of education.

The authors do note some limitations to their study. An important limitation to consider is that the data used in this study is data gleaned from historical records. In order to get a better sense of the continued efficacy or lack of efficacy of video training, the authors would need to conduct their own trials. The other big limitation is that the anesthesiologists were not blinded to the training the students received. According to the authors, the lack of blinding could have led to the anesthesiologists selecting easier patients for those students who underwent video training. Another aspect that the authors note is that they do not have any data regarding how long the video group retains its skills.

7.2
Given the results presented above, it is clear that the GlideScope training led to an increase in success rates and a decrease in procedure times. This study was conducted using forty two students with three intubation attempts each. There will definitely need to be more studies conducted in order to determine the efficacy of GlideScope training and video training in general. One of the positive aspects of the study is that the researchers did not have the students attempt the procedure on what experts determined to be easy patients. Additionally, each group conducted its attempts on similar patient populations controlled for age, weight, sex ratio and other factors.

8. Future Work and Relevance

Given the limitations indicated in the previous section, future work would address these problems. One of the first studies one can conduct is to do a longitudinal study to see if the significant increase in success

rates persists for a long period of time. The other thing to do in the future is to conduct an experiment where the evaluators are blinded to what kind of training the students receive. This will help prevent any bias. Naturally, we cannot blind the students because they will know which group they belong to based on whether they see the laryngoscopy videos or not.

8.1

Given that this study was conducted based on data taken in the Nineties, it would be better if the study was done using modern data. Doing such a study is beneficial because modern day mannequins are much more realistic. Additionally, modern day laryngoscope cameras have a better resolution and thus provide a better picture of the patient's anatomy. This allows students to get a better idea of what the anatomical landmarks look like.

This work is relevant to the project my group is working on because we are working on creating an android application as well as external adapter to create a low cost camera alternative to the towers currently in use. Additionally, our tablet solution will be more portable than the roughly human height towers. Given the efficacy of video training, our solution will allow for greater adoption of video technology. This is especially true given the scenario presented in this paper, where they looked at the records of students training to become emergency medical technicians. EMTs and emergency rooms typically do not have the towers available on call. Therefore, our portable solution allows doctors to pull out their Android smart phones or tablets, attach it to the end of a scope and examine the patient. For EMTs, this solution is useful because it becomes easier for them to get access to videos as a result of the image sharing component we are planning to build into the software. Lastly, the increased success rate in EMT training might translate into similar success in medical schools, where our solution gives multiple students the ability to see the exact same thing as the attending physician who is handling the scope. The low cost also helps with this aspect as well because medical schools do not have to spend thousands of dollars on the expensive towers, and thus can get more of our systems to use around the school.

8.2

The medical students will benefit from video laryngoscope training in the same ways as the EMT trainees. It allows them to observe the procedure from the same point of view as the senior anesthesiologists. The results also support my idea in the last section of how this sort of training can also benefit medical students. With improvements in video resolution, this training will get better. With regards to our project, our portable Android tablet solution will allow students more opportunities to receive video training because they are not reliant upon the expensive towers that are unable to move around easily. Thus, our solution will allow doctors to train their students in places such as the emergency room and other places where towers are not located.

9. Conclusion

Using videos during intubation training has shown promising results in improving the success rates of students who performed intubations later on. Moreover, given the success of the video training in this study, researchers should conduct more studies to determine whether such results are replicable. If they are, then video training has a greater chance of becoming part of the traditional teaching curriculum. This opens up the necessity for low cost methods for recording training videos and sharing them amongst students. That is where our low-cost, portable solution becomes useful. It will help make recording videos and obtaining pictures easier. With new technology, training methods will get better and lead to greater success rates.